

## Section 5-7: Diagonals and Angles of Polygons

**By the end of this lesson, you should be able to answer:**

- How are polygons classified according to their sides?
- How do you find the sum of the angle measures of polygons?

**Where you might see this in the real world:**

- Safety, hobbies, nature

Define the following terms:

1. Polygon

2. Side

3. Vertex

4. Convex

5. Concave

6. Regular Polygon

7. Diagonal

Many polygons have special names based on the number of sides they have. We've already looked at polygons with three sides (triangles) and four sides (quadrilaterals). What are the names of polygons with the following number of sides?

5:

6:

7:

8:

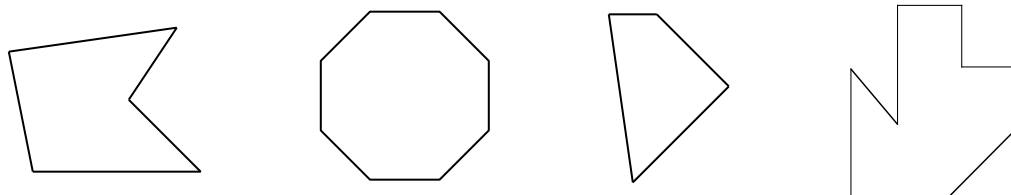
9:

10:

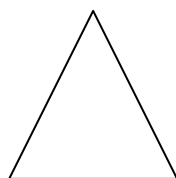
n:

Out of all of the polygons we know, all but triangles can be concave polygons. There is an easy test to see if a figure is concave or convex.

Example 1: Name each polygon by its number of sides and label concave or convex



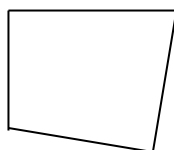
Just like in a quadrilateral, we can have diagonals. In a quadrilateral, our diagonals connected the vertices of opposite angles. In our quadrilaterals, the opposite angles were angles that did not share a side. In polygons with more than four sides, we don't have opposite angles, but we do have pairs of angles that do not share sides. We can draw diagonals between the vertices of these angles as well. This is helpful in figuring out the total number of degrees in the angles of polygons with more than four sides.



# sides

# triangles

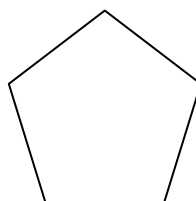
Degrees



# sides

# triangles

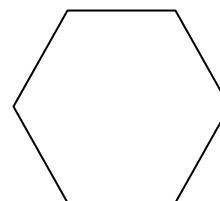
Degrees



# sides

# triangles

Degrees



# sides

# triangles

Degrees

This brings up a concept that allows us to find the total degrees in the angles of any polygon.

Angle Sum of a Polygon:

In an equilateral triangle, all the angles are  $60^\circ$ . In a square, they are  $90^\circ$ . Both of these figures are regular polygons. For any regular polygon, we have a formula to find out what each angle would equal.

Angle Measure of a Regular Polygon:

Example 2: In hexagon ABCDEF,  $m\angle A = m\angle B = 10x$ ,  $m\angle C = m\angle D = 3x + 8$ ,  $m\angle E = 7x - 22$ , and  $m\angle F = 8x - 12$ . Find the sum of the measures of the hexagon, then find the measure of each angle.

Example 3: Find the measure of each angle of a regular 14-gon.

Problem Set:

*"Liberty without learning is always in peril; learning without liberty is always in vain."*  
*- John F. Kennedy*